THE LABOR PROBLEM ON THE PANAMA CANAL.

BY BRIGADIER-GENERAL PETER C. HAINS, U.S.A.

IT is reversing the usual order of things to discuss the method of executing a great engineering work before all the details of the project are definitely settled. At the same time, where it is practically certain that the project can be forecasted within certain narrow limits, this may be done to advantage. The route of the canal is fixed by law, and the work already done by the Panama Canal Companies must be utilized. The plan, therefore, in a general way, follows as a logical result; the details alone are subject to modification. As the method of constructing will not be affected by minor modifications in the project, discussion of the labor problem will not only be of interest but cannot fail to be of advantage.

The law requires that the canal "shall be of sufficient capacity and depth as shall afford convenient passage for vessels of the largest tonnage and greatest draught now in use and such as may be reasonably anticipated." But who can tell what may be reasonably anticipated? Judging the future by the past, we may anticipate ships to be 1,000 feet long and 100 feet beam inside of 50 years. The Isthmian Canal Commission fixed upon 740 feet for the length of the locks, yet the ink with which the members penned their signatures to its report was scarcely dry before it was reported that the Cunard Line was about to begin the construction of one or more ships that would be too long to go through them.

It is not my present purpose, however, to discuss the plans of the canal. The problem of sanitary control is of most immediate importance, and steps have already been taken looking to its solution. There is one matter connected with it, on which there has been a good deal of thoughtless speculation—that is, in regard

to the number of laborers to be provided for. We frequently hear it stated that 40,000 to 50,000 laborers will be required on the Isthmus. This seems to be an overestimate.

It is not difficult to estimate approximately the number of laborers that will be required under proper management, and it is assumed that there will be proper management. It would embarrass operations to have a greater number of people there than can find profitable employment. The work of digging the canal is not going to be done by an army of laborers, equipped with spades and shovels, but by machinery, operated on modern methods by steam or electric power. A large number of workmen, skilled and unskilled, will be required even under these conditions; but it is not probable that the number will ever reach anything like 40,000.

Nearly all the excavation between the Atlantic Ocean and the Bohio Dam, a distance of fifteen miles, most of that between Bohio and Bas Obispo, a distance of twelve miles, and nearly all that between Pedro Miguel locks and the Pacific Ocean, a distance of eight miles, will be done with dredges, and comparatively few men will be needed. In other words, of the total 47 miles of the canal, about 35 of it will be excavated chiefly with dredges, requiring but few laborers. The Culebra Cut, located between Bas Obispo and Pedro Miguel, is heavy work and is the feature which will determine the time of completing the canal. It is impossible to employ more than a certain amount of machinery on this Cut to advantage, and that fact will limit the number of employees. The other works, such as the Bohio Dam, the locks and the spillway, need not be hurried, as their early completion would not affect the time of opening the canal to navigation. The work on the Great Cut should be pushed energetically; but, unfortunately, the conditions are such that rapid progress cannot be made there.

The Chicago Drainage Canal is 34 miles long, while the Panama Canal is 47. The maximum number of employees on the former at any one time was about 8,000. It is not probable that the ratio of number of employees to length of canal at Panama will ever exceed that at Chicago. It is more probable that it will be less, because of the proportionately larger amount of work that can be done with dredges. The Canal Company has now about 700 men, who remove less than 700,000 cubic yards a year, but their appliances are not well adapted to the work. The Isthmian Canal Commission called attention to this fact, and, in estimating

the value of plant, attached no value whatever to that now in use there, because it is out of date. It will be better to throw the present plant away and procure new machinery. With modern appliances and the same number of men, the output ought to be more than doubled. At the present time, the output amounts to less than four cubic yards per day per man—a small amount, considering the character of the material and the part of the cut from which it is taken. With good machinery, there ought to be no difficulty in excavating ten cubic yards per day per man. At that rate, the employment of 2,000 men on the Culebra Cut would effect an output of about 6,000,000 cubic yards per year, which would complete the cut in about seven years. It is not probable, therefore, that more than 3,000 men will be employed at any one time on the Great Cut.

The greatest number ever employed at any one time on the Poe Lock at Sault Sainte Marie, the largest lock ever built, was about 760, and that was only for a short period in 1893, when the masonry work was being pushed with the greatest energy. The average number of men employed on it during the seven years consumed in its construction, was not more than about 300. During the two years 1892 and 1893, when the greatest number were employed, the average for the working months, from May to December, inclusive, was only about 500 men. If we allow double that number on the locks at Bohio, Pedro Miguel and Miraflores, we would only have 3,000 men on lock construction; and, allowing 1,000 on dredging, 1,000 on the Bohio Dam, 1,000 on Alhajuela Dam, 1,000 on Gigantic Spillway and 1,000 for other work, we would have a total of 8,000. If this be increased by twenty-five per cent., the total number would be only 10,000. This would seem to be a liberal estimate.

Next to the determination of plans for the canal, the most important question is the method of doing the work and of securing labor. Should the work be done by contract, or should it be done by day's labor? If by contract, should it be let to a single firm or syndicate that could command sufficient capital to carry it through, or should it be let in a number of smaller contracts? These are questions of great importance, which have thus far received but scant consideration. Moreover, there is room for a wide divergence of opinion among engineers. Each method has its advantages and disadvantages.

There are some advantages in letting the work to a single firm or syndicate, rather than to a number of firms. That course would enable the Government to determine immediately just what the work ought to cost. The estimates heretofore made are approximate only, and actual cost will vary from these figures sometimes one way and sometimes the other. But, after a contract is made for the entire work, the cost will be definitely fixed.

To let the work to a single firm or syndicate would relieve the Commission of an immense amount of labor, at least it would seem so; but it is not easy to draw specifications for a great work like this, with so many possibilities of error, without greatly enhancing the cost. There are always matters connected with a large engineering work that are overlooked, and others that it may not be possible to specify with accuracy at the outset. Things crop up during the course of the work which could not be foreseen. It is possible to insert a blanket clause that will cover all such contingencies, but to do so would neither be fair to the contractor nor just to the United States, for it would throw all the risk of errors of judgment on the contractor, and a contractor cannot afford to take such risk without charging for it. If the contractor takes the risk, he must put up his price. If the Government takes the risk, it must take the chances for controversies and claims.

The old De Lesseps Company tried the contract plan, but it failed to give satisfaction. The prices were all high. If an engineer refused to accept work because he believed it did not come up to the specifications, the matter was referred to Paris and he was overruled. Similar results, to some extent, would follow under American management; conflicts of opinion between engineers and contractors are inevitable. If the engineer be overruled, as he often will be, and sometimes ought to be, he, as well as other engineers, will become timid, unwisely yielding to the contractor's claims. This will happen even when both the contractor and engineer are honest; if either or both are dishonest, a worse condition follows.

The more powerful the contractor, the greater the difficulty of enforcing a strict compliance with specifications. Contractors, as a rule, are not dishonest. There are contractors who would rather lose all than claim a single dishonest dollar, but they are human and self-interest distorts the vision in spite of all efforts to the contrary.

It is, therefore, better that the contractor be not too powerful. In other words, it would be better to let the work to a number of smaller contractors. If the work were located in the United States, this method would undoubtedly be chosen. Such was the method employed on the Chicago Drainage Canal, and it is the method usually adopted on enterprises involving many different kinds of work.

The letting of the work to a single firm will naturally tend to increase the cost. The construction of the canal calls for many classes of work requiring men especially skilled in each; so that, if a single firm had the contract, it would sublet these special classes. The subcontractor and the principal would each expect a profit, with the result that the Government would pay a profit to both.

Under either system of contracts, it will be difficult to maintain proper sanitary control. Contractors will go to the Isthmus to make money. They will procure the cheapest labor obtainable, without regard to other considerations. Every contractor who goes to the Isthmus will find it necessary to complete his work and get out as quickly as possible. The Panama Isthmus is not a health resort, and it will not become one after complete sanitary control is established.

It may be said that there is no reason why the Government should not enforce regulations to preserve the health of the community within the ten-mile zone, just as is done within the United States. That is true. But the conditions are different. Panama and Colon are not included in the zone that comes under the complete control of the United States; and, though the treaty gives the United States power to establish sanitary conditions in these cities, still the fact remains that they are Spanish-American cities with all that it implies. A heterogeneous crowd such as will be drawn to the Isthmus will be difficult to manage. They will bring with them the habits, the prejudices and the diseases peculiar to their native lands. Along with them will come a multitude of parasites of the lowest classes.

In view of the peculiar and unusual conditions at Panama, the best method for the Government to pursue is, to employ its own labor and purchase the machinery by contract. Many advantages would result from following this plan; the control of the Government over the labor and sanitary problems would be absolute,

while there would be no danger of contractor's claims being made at the termination of the work.

Perhaps it will be claimed that work done by labor employed by the Government costs more than similar work done by contract. This is sometimes the case, but not always. Much depends on the individual characteristics of the person directing the work, whether he be an employee of the contractor or of the Government. If he be an employee of a contractor and fails to conduct the work efficiently and economically, he loses his job; if he be an employee of the Government, he may be retained in service and sent elsewhere. But there ought to be no difficulty in the Government's securing the services of men who can direct work efficiently and economically; work is often done by the Government far more efficiently and economically by day's labor than by contract. The work on the canal is a new one. It will require new tools and new machinery. Contractors would have no advantage over the Government in securing good machinery. Could he secure labor at lower rates than the Government? It is believed that the reverse is true; that the United States can secure labor on the Isthmus at lower rates than any contractor or set of contractors. The cost of labor on the Isthmus within the last few years has been low; previously under the old Company it was high. But the work done by the New Company has been largely for the purpose of keeping the concession alive and determining the character of the problems to be solved.

The lowest estimate of the time required to complete the canal is about eight years; but bad management, a war between the United States and some naval Power, an epidemic of yellow fever, a temporary change in the sentiment of the people of the United States toward the project, would cause delay that might postpone completion for years. Under such circumstances, a contractor might have a valid claim against the Government, the amount of which cannot be estimated. If the work be done by the Government, some loss and delay might ensue, but the loss would be of such a nature that only Government interests would suffer and the delay would cause no special embarrassment.

Captain F. A. Abbott, of the Corps of Engineers, U. S. A., in his Annual Report for 1896, made the following statement in regard to the work on the improvement of the Santee River:

"The total excavations on both canals up to June 30, 1892, amounted to 221,450 cubic yards, measured *in situ*, and had been done by contract, except 1,169 cubic yards. Dividing the total expenditures to June 30, 1892, for all purposes, by the above number of cubic yards excavated, shows the average cost of dredging here by contract to have been 51 cents per cubic yard, measured in place. Between June 30, 1892, and September 30, 1892, 26,694 cubic yards were dredged by a hired dredge and the United States employees at a cost of about 24 cents a yard, measured in place. Dredging was then stopped, and work on a new dredge owned by the United States was begun. At the close of June, 1893, this dredge was nearly ready for work. It was a powerful dredge of the Osgood pattern, with main engines 12 inches in diameter and 18 inches stroke. The new dredge began work on the canal November 21, and was operated continuously till April 30, 1894, when it was laid up, as the funds were getting low and the old rice-field lands where it was working were excessively sickly. During the five months it excavated 6,075 linear feet of canal, 7 feet deep and 50 feet wide, at a cost of 3.7 cents per cubic yard, measured in place. In this price every expenditure made from the appropriation for any purpose is included. More work was done by the United States with its own labor and dredge in five months than had been accomplished by contract on this improvement in any two years. The cost was $4,000, as compared with about $30,000 under the most favorable contract ever obtained here for like work and equal advance of canal. The work was also more thoroughly done."

In the following year, he made this statement:

"The dredge owned and operated by the United States continued dredging, extending the canal 6,500 linear feet, 50 feet wide and 7 feet deep at low water, and cut a turnout aggregating 1,250, making the total excavation 7,750 linear feet, which corresponded with 121,845 cubic yards and 1,102 stumps. . . . The dredging during the year has cost 4.9 cents per cubic yard. The cheapest contract price ever received was 37½ cents per cubic yard, exclusive of superintendence."

The same officer, in his report for 1896, referring to the improvement of Charleston Harbor, stated:

"In 1891, the Government plant, operated by hired labor, and Mr. Friday's plant operated under his contract, worked together, the former on the south and the latter on the north jetty. It was found that the cost that year by hired labor was $1.70 per ton, including office expenses, and superintendence, as compared with $2.20 per ton for exactly the same work by contract, including inspection."

On the work of the Potomac Flats Improvement at Washington, some years ago, bids for embankment work along the margin

of the fill were invited. The lowest bid received, after public advertisement for proposals, was about 16 cents per cubic yard. The bids were rejected and the same dredges that were to have been used were hired from the lowest bidder at a price that gave him a profit, and enabled the Government to do the work at about one-half the cost it would have been had it been let by contract.

The above are examples showing that Government work does not always cost more than work by contract. On the Santee River, the conditions were similar in some respects to those on the Isthmus. The place was so unhealthy that only negroes could work there, and even they suffered from malaria to some extent.

But were it true that the work would cost a little more if done by day's labor, it is believed that this is the best way to do it. The United States does not stand in the position of a private corporation with reference to this canal. A corporation would build it, as other canals are built, for what could be made out of it, by levying tolls on commerce. Of course, the Government expects a return from its investment; but it will be chiefly in the development of the industries of the country, the advantages it affords for national defence and for the general good of mankind. The motive is as high morally as the work is grand physically. There will be loss of life in carrying out the enterprise, even under the most favorable conditions; but if the work be done by the United States employing its own labor, the loss of life can be kept at a minimum, even though the work cost more money.

One of the objections to the Panama route was, that the scandals connected with it in the early days had so outraged the public conscience, that decent people hesitated to take up an enterprise that had been so tainted with fraud. The fact that the New Panama Canal Company had rescued it from its former pitiable condition did not count for much. Many people were hostile to it just the same. They said, "We want nothing to do with an undertaking so foully smirched." If, however, the work be done by the United States directly by employing its own labor, there ought to be no room for scandals.

This great Government can procure labor and machinery at as low prices as contractors can. It matters not where the labor may come from, whether from Asia, Africa or America. The problem of securing it may be troublesome, but it will not be rendered less so by shifting the responsibility on a contractor.

Another question is, Where will the labor come from? White labor from the United States, except in the mechanical trades, is out of the question. The number of laborers of any color or kind on the Isthmus is small, and the quality poor. Along the line of the railroad between Colon and Panama, there are settlements composed of people from almost every clime on the face of the earth, but they will furnish few laborers. Perhaps 1,500 or 2,000 Jamaica negroes could be obtained. The native Isthmian will not work. He is naturally indolent; not over strong; has no ambition; his wants are few in number and easily satisfied. He can live for a few cents a day, and he prefers to take it easy, swinging in a hammock and smoking cigarettes. The native population is wholly unavailable.

The Jamaica negro, and under this term are included the negroes of most of the islands under British control, makes a good laborer. He is fairly industrious; not addicted to drink; can speak English; has ambition, though it is chiefly to become an independent British subject; he is willing to work, but he must have an inordinate number of holidays. He is alert in driving a bargain, and possesses many of the traits of our own native down-easter. He is not deficient in intelligence, and he recognizes conditions that are favorable to bargain-making quite as readily as his northern neighbor. When the demand for labor becomes greater than the supply, he will be quick to grasp the situation and make the best of it. He lays great stress on being a British subject, and vehemently claims British protection whenever he thinks his rights are invaded or curtailed. But there is not enough of these negroes on the Isthmus, and it is doubtful whether or not the Islands can supply the deficiency.

The Chinese coolie will stand the climate; he is industrious, not difficult to manage; but he cannot speak English, and, as soon as he gets a few dollars, he wants to keep a store. Will the people of the United States consent to the importation of coolie labor for this work?

Contractors would naturally want to import coolie labor, because it is cheap and the supply is practically inexhaustible. The Panama Canal Company tried coolies and also negroes imported direct from Africa, but neither gave satisfaction. With both classes came diseases which carried off many and rendered others helpless.

Weighing all the circumstances and viewing all the conditions, it seems that the best solution of the labor problem is to procure the labor in the United States. The Southern negro, just as well as the Jamaica negro, accustomed to the warm climate of our Southern States, it is believed, would furnish an excellent class of labor for work on the Isthmus. He is American born, speaks the language of the men under whom he will serve, is amenable to discipline, is temperate in his habits, is not honeycombed with disease, is intelligent, industrious and ambitious; the money that is paid to him will, as a rule, return to the United States. That he can stand the climate is the firm conviction of many who have sought a practical solution of the labor problem.

As already stated, the work will be done largely by machinery, which will require a considerable number of men skilled in the various mechanical trades. A large number of engine-men, to do work for which the ordinary laborer is not fitted, will be needed. Mechanics will, as a rule, from necessity be white men, but their stay on the Isthmus should not be prolonged. White mechanics and colored laborers from the United States and the West-Indian Islands would seem to offer the best solution of the labor problem on the Isthmus. The army of the United States is composed partly of colored troops. It is the universal testimony of officers that they make excellent soldiers and can stand the heat of the tropics.

The ordinary laborers should be divided into two classes, with a slight difference in pay to encourage individual industry and attention to duty. They should agree to work for two years, unless sooner discharged. They should be quartered in buildings provided by the Government, supplied with good, wholesome food, a certain amount of light cotton working-clothes and medical attendance. At the end of two years' creditable service, they should be entitled to discharge and transportation back to the place at which they were recruited. This would apply whether they came from the United States or from the Islands of the Caribbean Sea. No man should be engaged and sent to the Isthmus who is not physically and mentally sound and fitted for the work, to determine which he should be required to pass an examination no less rigid than that for enlisting men in the army. Similar but less stringent rules should apply to mechanics, clerks, draftsmen, overseers, etc.; but, inasmuch as many of these would be engaged

for shorter periods of service, special rules would govern in such cases.

The men should be divided into squads, with a master-laborer or master-mechanic at the head of each, according to the class of men that compose it. A master-carpenter, for instance, would have a certain number of carpenters under him, a master-mason a certain number of masons, and so on. Two or more squads of laborers or mechanics would be under an overseer. The overseers, in turn, would be subordinate to the engineers. The latter would be assigned to special works, such as the construction of a dam, lock or a section, and the number of overseers, etc., under him would depend on the extent and character of the work in his charge. All matters pertaining to the pay of the men, except keeping the time, should be attended to by a Pay Department.

A certain number of physicians should be assigned, to see that the hygienic conditions are kept up to the proper standard, and to determine when a man is fit or unfit for work.

The details of the foregoing plan could not, perhaps, be worked out beforehand. Many would be settled according to conditions arising from time to time. The main idea is to secure an organization of laborers and mechanics, working directly under the Government and under the absolute control of the officers for all purposes of work, similar to the organization of an army. Such an organization would be impracticable under the contract system.

The construction of the Panama Canal is the greatest engineering work that has ever yet been undertaken by man. All other canals sink into insignificance beside it. The Suez Canal, which gave De Lesseps an undeserved reputation as an engineer, is nothing more than a ditch cut through a low neck of land connecting the continents of Asia and Africa. There were no special difficulties to be overcome. The quantity of excavation was large, but it seemed larger than it really was, because the tools with which it was done were far below the present standard of efficiency. The fear was that after the light, sandy soil had been excavated and piled up on the sides, the wind might blow it back into the canal faster than it could be taken out. At Panama all kinds of difficult engineering problems are to be met and solved. An engineering organization the most complete and perfect of its kind is therefore essential for the economical and efficient construction of this vast work.

An organization of mechanics and laborers modelled on the plan thus outlined or on similar principles, will, it is firmly believed, meet the physical requirement of the labor problem at Panama in a less objectionable manner than any other. But something more is needed. This organization will form a body of men capable of performing efficient service only when properly directed. Each particular part of the organization must work in harmony with the other parts, else there will be confusion. The organization must, therefore, have a head with brains, to direct harmonious action. There should be one Chief Engineer having entire charge of all matters relating to construction, and not burdened with outside matters. On this chief the responsibility for the faithful execution of the work should fall. Hence, he should have authority. This authority should be supreme in all matters relating to construction; in other matters it might be limited. He need not be responsible for the plans, but he must be for their faithful execution. If he has a doubt as to their practicability, he should resign his trust. If he desires counsel and advice on any matters within the scope of his duties, he should be enabled to refer such matters to a Board of Experts, who could give more study to the question than he. Except in an advisory capacity, it is believed that Boards are undesirable. It is notorious that they are inefficient for executive work. The Secretary or Chairman or some other member becomes the moving power, and the Board becomes a screen. Responsibility must be concentrated to be effective. The larger the Board, the greater its incompetence in executive business. In an advisory capacity Boards may be of great value, but their functions must not extend to executive work.*

The Chief Engineer should be a man in vigorous health, not too far advanced in years and yet possessing the discretion and judgment that come with years. He should have had experience in the management of men and works, and a thorough knowledge of the principles of engineering. An engineer is not a spontaneous growth. Eminence in his calling is only reached by hard work and a diligent application to all the intricate arts of the profession.

* Since the above was written a Chief Engineer has been appointed. The writer is not personally acquainted with him, but it is understood that he possesses in a high degree the qualities mentioned.

Under the immediate orders of the Chief Engineer there should be a certain number of Division Engineers, each having direct charge of the work of his division. These Division Engineers should be men of the same high professional attainments as the chief, lacking only, perhaps, his experience. They should be capable of taking the place of the chief, if circumstances should make it necessary.

Geographically, the work on the canal will naturally be divided into three divisions, the Atlantic, the Central and the Pacific. The first would comprise all the work between the Caribbean Sea and the Bohio Dam, including the dam, the locks and spillway; the second should include all work between the Bohio Dam and the Pedro Miguel locks, but not including the latter; the third should include the Pedro Miguel locks and the work between them and the Pacific.

With such an organization, it is believed that the work can be carried on efficiently, economically and with credit to the Government that has undertaken the solution of this great problem in which the entire world is interested.

PETER C. HAINS.